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Study of the correlation between general motor coordination and the visuospatial component of working memory in children

دراسة العلاقة بين التنسيق الحركي العام والمكون البصري المكاني للذاكرة العاملة عند الأطفال

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Abstract

Achieving an exceptional sporting result requires the rapid and precise deployment of the necessary skill at a specific time; and because the memory system is responsible for coordinating and archiving information for successful action planning and decision making The objective of our study is to study the correlation between general motor coordination assessed using the Charlop-Atwell scale (Adaptation of JM-Albaret 1994) and the visu spatial component of working memory (mémorisation capacity), assessed using the Corsi cube test calibrated by Fournier et al. (2014)..Our sample is made up of 49 children whose average age is 6.10 ± 16 years old who are about to start training in a volleyball school within a club affiliated with the wilaya league of Algiers in this case. which has alluded to the link that exists between working memory and coordination (control of motor skills),

ملخص:

يتطلب تحقيق نتيجة رياضية استثنائية الاستيعاب السريع والدقيق للمهارات اللازمة في وقت محدد ولإن نظام الذاكرة هو المسؤول عن تنسيق المعلومات وحفظها للتخطيط الناجح للإجراءات واتخاذ القرارات

هدفت دراستنا الى دراسة العلاقة بين التنسيق الحركي العام الذي تم تقييمه باستخدام مقياس Charlop–Atwell (تكييف JM–Albaret 1994) والمكون البصري المكاني للذاكرة العاملة (سعة الحفظ) ، التي تم تقييمها باستخدام اختبار Corsi cube معاير اخترنا عينة مكونة من 49 طفلاً يبلغ متوسط أعمارهم 6 ± 16 عامًا ، وهم على وشك البدء بالتدريب في مدرسة للكرة الطائرة ضمن نادٍ تابع لدوري ولاية الجزائر وقد تم التوصل الى الارتباط الموجود بين الذاكرة العاملة والتنسيق الحركي (التحكم في المهارات الحركية

Introduction

Achieving an exceptional sporting result requires the rapid and precise deployment of the necessary skill at a specific time, according to Rigal et al 2009 it depends on the decision-making capacity which in turn depends on the ability to processing information, its coding and its storage, this purely cognitive path requires a capacity for logical-mathematical analysis through numbering, the principle of conservation, categorisation and serialisation,
Soppelsa et al 2006 argue that the mastery of operations and logical reasoning make it possible to make causal links and to draw conclusions from hypotheses in order to solve problems and make decisions, which coincides during motor learning according to Schmidt 1993 at the stage of implementation of the solution of the problem which precedes the automation of this solution. And Nouraddine kouadri who proposed program for kinetic games as a basis in developing some cognitive abilities (sense-motor) for pre-school children (4-5) years

Motor, psychomotor education and physical and sports activity play a determining role in the development of this decision-making capacity, according to Schmidt 1993, the construction of motor skills and the production of high-level sports performance in the future,
these activities allow the improvement of motor coordination and motor development found in gross motor skills (stabilizing and locomotors activities), and fine motor skills (manipulative activities). the type of relationship that exists between the kinetic capacities represented in each of kinetic balance and compatibility, agility and flexibility and certain cognitive mental processes (intelligence and attention?

Several authors (Theabault 1998 et al; Paoletti1999; Pfefferlé et al 2011,) assert that motor coordination which is acquired through learning makes it possible to adapt motor behaviour quickly and effectively in order to solve concrete tasks during. From predictable and unpredictable situations, motor experiences enrich the range of possible solutions and memorisation plays a primordial, even determining role.
The relationship of mental perception to tactical thinking has been highlighted according to Ridha malek

The operation of memorising information is a high-level mental function, relatively complex, there are several types of memories which are independent of each other but which interact with each other.

According to Duche et al. 2009, working memory is a limited capacity system that maintains and stores information temporarily, supports human thought processes by providing an interface between perception, long-term memory and action, Pickering 2001 maintains that she has a mental workspace for a period of a few seconds and is part of the “definitive” memorisation process.

Working memory is intimately linked with procedural memory, which records the procedures when learning a sports technique. The objective of our study is to study the correlation between general motor coordination assessed using the Charlop-Atwell scale (Adaptation of JM-Albaret 1994) and the visuospatial component of working memory (memorisation capacity), assessed using the Corsi cube test calibrated by Fournier et al. (2014).

Our sample is made up of 49 children whose average age is 6.10 ± 16 years old who are about to start training in a volleyball school within a club affiliated with the wilaya league of Algiers in this case (RAMA) .

1. Assumption:

There is a significant correlation between general motorcoordination and the visuospatial component of working memory(memorisation capacity) in 6-year-old children.

2. Researchobjectives:

Our research work consists of evaluating motor coordination and workingmemory in Six-year-old children and studying the correlations that mayexist between general motor coordination and the visuospatial component of working memory in children of six years.

3. Means andmethods:

3.1 Samples of our research: Our study sample is composed ofchildren enrolled in the volleyball school of a club in the wilaya of Algiers whose average age is 6.1 ± 0.16 years, our sample is composed of 49 children (23 girls and 26 boys), we do not take into account the sex variable, according to Albaret 2014 there is no significant effect of this factor.

We carried out the Charlop-Atwell scale and the Corsi cube test between January 07 and February 21, 2012, we calculated the age permonth by referring to the date of February 1, 2020 .

3.2 Tests and materials used

3.2.1 Charlop-Atwell scale: These two authors developed their test taking into account the problems of duration of the test and the expensive nature of the equipment of the available measuring instruments.

Their concern was to reduce the procurement time and cost while highlighting the differences between individuals in the quality of performance.

The objectives respond to practical imperatives, in the concise development of intervention programs, but also to theoretical imperatives concerning psychomotor development.

Access to the mature stage of a motor capacity is far from the rule and can vary according to age, sex, influence of environment (J-M-Albaret 1994) Variations also exist at the intra-individual level between the various capacities, which can lead to the coexistence, within the same behaviour, of several patterns which have reached different degrees of maturity.

The six-item test is subdivided into four categories:

- A. Coordination between upper limbs and lower limbs bringing together "the puppet" and "the prehistoric animal", these two items also measure the ability to learn motor tasks quickly and precisely.
- B. Coordination of two simultaneous actions with "jump with half turn" and "spin".
- C. Dynamic balance represented by "successive jumps on one foot".
- D. Static balance, on tiptoes.

The objective criteria determine the success and the level of precision of the performance. The maximum score is 6 points per item with the exception of the jump with a U-turn which is scored on 4 points because of its easy performance and the "prehistoric animal" item scored on 10 points because it is the most suitable for discriminate between individual differences. The objective criteria take into account the number of trials required and the time.

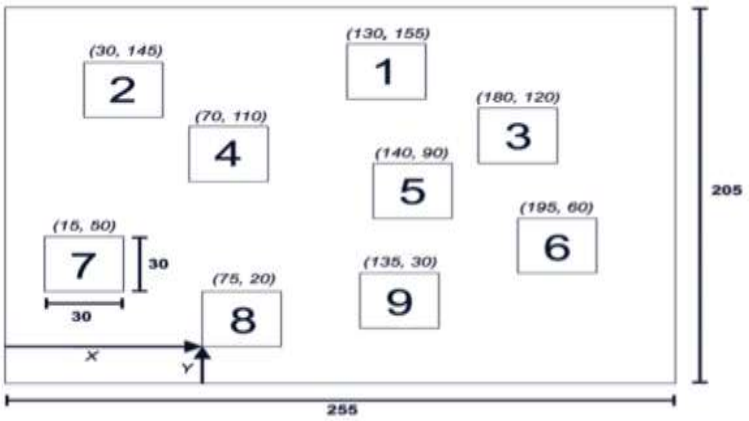
The subjective criteria make it possible to specify the level of maturity and the qualitative aspect of the performance which may vary for an identical objective score, three in number, they are assigned to a maximum score of 2 points with precise instructions for each item .The first criterion concerns harmony and fluidity based on the continuity of movement, the ability to anticipate (presence of pauses, sudden interruptions of movement), the second concerns the precision

with which the movement is performed and the third criterion is that flexibility, fluidity or on the contrary rigid and jerky of the gestures.

During the administration of the scale, each child must be tested individually by the examiner, the time necessary for the completion of the items and their marking is 15 minutes per child, the instructions accompanied by demonstration are given for each item, l the examiner will establish a good relationship with the child during the
administration of the scale.

3.2.2 Test of: "Corsi cubes" : The Corsi cube test has been used for several years inneuropsychological evaluation, it involves the memorisation of sequences of spatiallocations, this test measures the visuospatial component of working memory and consistsof reproducing, in the same order or in reverse order, a sequence of pointing movementsof different cubes shown by the observer. The number of blocks gradually increases andmakes it possible to determine the visuospatial span which is the maximum number ofblocks that the subject recalls without error.

The three-dimensional tool comprises a blackboard on which are placed nine identical black cubes, the sequences are shownsuccessively by the examiner who points with his finger at different series of cubes, at afrequency of about one cube per second, then one asks to the participant to show again immediately after, the sequence by pointing himself the cubes in the same order. There are different versions, the one retained in the framework of this study is that proposed byKessels et al. 2000.



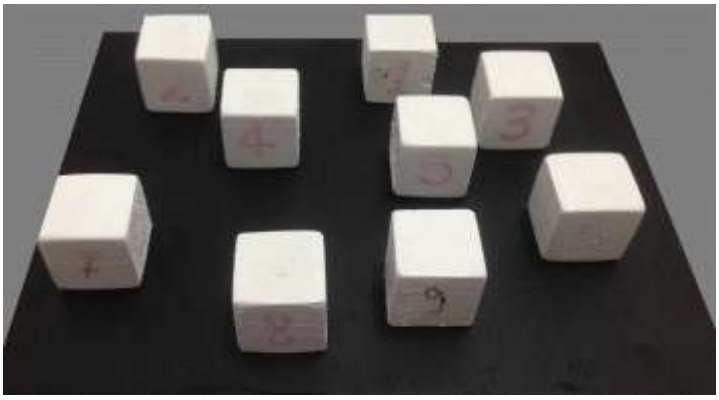


Figure 1: Plan of the Corsi block test after Kesselset al.(2000)

Figure n ° 2: Corsi blocks used during the component evaluation visuospatial of working memory.(Adapted from Kessels et al., 2000.)

Table n ° 1: Sequences in place and reverse recall condition.

Sequence in location recall condition			Sequence in reverse recall condition		
Exemple	2-6	7-9	Exemple	1-8	4-6
Level	Trial 1	Trial 2	Level	Trial 1	Trial 2
2	8-5	6-4	2	9-4	7-5
3	4-7-2	8-1-5	3	6-8-5	4-6-3
4	3-4-1-7	6-1-5-8	4	2-5-1-8	9-3-5-2
5	5-2-1-8-6	4-2-7-3-1	5	5-3-2-9-7	3-1-9-4-7
6	3-9-2-4-8-7	3-7-8-2-9-4	6	1-6-8-4-7-5	2-6-9-3-8-5
7	5-9-1-7-4-2-8	5-7-9-2-8-4-6	7	5-3-8-6-2-7-4	2-3-8-5-1-9-7
8	5-8-1-9-2-6-4-7	5-9-3-6-7-2-4-3	8	4-9-1-6-3-8-7-5	4-8-5-9-2-1-6
9	5-3-8-7-1-2-4-6-9	4-2-6-8-1-7-9-3-5	9	3-7-8-1-2-6—4-9-5	1-5-6-3-8-4-9-2-7

During the test, the subject is seated in front of the examiner who points with his finger (or with a pen) a series of cubes one after the other,starting with the sequence of 2 cubes,the child must repeat eachsequence in order, immediately after the demonstration.

To perform the statistical study, we used Excel 2016 and Statisticaversion 10 software to calculate the arithmetic mean, standard deviation,covariance and Pearson's correlation coefficient.

4 . Results

4.1 Evaluation of the visuospatial component of working memory - Corsi's cubetest:

The test reveals that the front and back span of our sample, an average score of 3 ±1.49 and 1.75 ± 0.97 respectively.

On the other hand, we have a maximum score for the right and back span respectively of 5 and 4. Also a minimum score for the right and back spanrespectively of 0 and 1, we observe a great heterogeneity of the group in terms of l'Empanfront and back.

The results recorded are low compared to the calibration of Fournier et al.2014, according to Marion 2010 and Masson 2012 several criteria can influence thisparameter from birth among them the way to evolve within the family and at school, itwould therefore be essential to carry out other tests to identify the causes of these delays and remedy them.

Table n ° 2: Results of the "Cubes de Corse" test (right and back span).

	Empan endroit	Empan envers
Average	3	1,75
Standarddeviation	1,49	0,97
Max	5	4
Min	0	1
C.V%	50	55

4.2 Results of the assessment of general motor coordination according to the Charlop-Atwell scale:

The sample records an average total score of 47.05 ± 19.86, while the objective and subjective scores are respectively 28.75 ± 11.76 and 18.3 ± 8.27, there is a

great heterogeneity in total, objective and subjective score. These results are low compared to the Albaret 1994 calibration.

Table 3: Overall result in passing the Charlop-Atwell scale.

	Total Score	Objective Score	Subjective Score
Average	47.05	28.75	18.3
S Standarddeviation	19.86	11.76	8.27
Max	79	48	31
Min	21	13	7
C.V%	42	41	45

4.3 Result of the Char lop-Atwell scale by Items:

4.3.1 Item of the puppet

At the precision of the movement, an average is recorded of 1.45 ± 0.75, with maximum and minimum values respectively of 4 and 1, at the fluidity of the movement, an average of 0.7 ± 0.57 isrecorded with maximum and minimum values of 2 and 0 respectively.

And with the flexibility of the movement there is an average of 1.15 ± 0.58 We note agreat heterogeneity of the group.

Table n ° 4: Result of the handover to the PANTIN Item.

	PANTIN Item		
	Precision of movement	Fluidity	Flexibility
Average	1,45	0,7	1,15
S Standarddeviation	0,75	0,57	0,58
Max	4	2	2
Min	1	0	0
C.V%	52,35	81,60	51,05

4.3.2 The item of the Jump with U-turn:

With the precision of the movement, one notes anaverage of 1.45 ± 0.48, with a maximum and minimum value, respectively of 2 and 1. With the flexible structure one notes an average of 0.85 ± 0.79 with Max and Min value respectively of 2;0.

Table n ° 5: Result of the passage in the item of JUMP WITH HALF TURN.

	Jump Item with U-turn	
	Precision of movement	Flexibility
Average	1,4	0,85
Standarddeviation	0,48	0,79
Max	2	2

Min	1	0
C.V%	34,99	93,19

4.3.3 HoppingItem:

With the precision of the movement, one notes an average of 1.35 ± 0.57, with maximum and minimum values respectively of 2; Zero at the fluidity of movement we find an average value of 0.7 ± 0.55 with maximum and minimum values respectively of 2; 0 and at the flexibility of the movement we record an average of 1.1 ± 0.62 with a value the group and very heterogeneous

Table n ° 6: Result of the BELL JUMP Item.

	Jump item on the bell foot		
	Precisionof movement	Fluidity	Flexibility
Average	1,35	0,7	1,1
Standarddeviation	0,57	0,55	0,62
Max	2	2	2
Min	0	0	0
C.V%	42,39	79,53	56,77

4.3.4 Prehistoric Animal Item:

At the precision of the movement, we recorded an average of 1.35 ± 0.65, with maximum and minimum values respectively of 2 and 0, at the fluidity of the movement we recorded an average value of 0.7 ± 0.55 with maximum and minimum values respectively of 2 and at the flexibility of the movement we recorded an average value of 1.2 ± 0.61.

Table 7 - Result of the PREHISTORIC ANIMAL Item.

	Prehistoric Animal Item		
	Precisionof movement	Fluidity	Flexibility
Average	1,35	0,7	1,2
Standarddeviation	0,65	0,55	0,61
Max	2	2	2
Min	0	0	0
C.V%	48,43	79,53	51,29

4.3.5 SpinningItem:

With the precision of the movement, one notes an average of 1.4 ± 0.58, with a maximum and minimum value respectively of 2; 0, the fluidity we record an average of 0.6 ± 0.48 with a maximum and minimum value respectively of 1; Zero and at flexibility we recorded an average of 1.2 ± 0.6.

Table 8: Result of the TOURNAMENT Item.

	Spinning Item		
	Precision of movement	F Fluidity	Flexibility
Average	1,4	0,6	1,2
S Standarddeviation	0,58	0,48	0,6
Max	2	1	2

Min	0	0	0
C.V%	41,64	81,64	50

4.3.6 Balance item on tiptoes:

With the precision of the movement, one notes an average of 1.4 ± 0.58, with a maximum and minimum value respectively of 2; 0, at fluidity an average of 0.65 ± 0.57 is recorded and at flexibility an average of 1.1 ± 0.7 is recorded.

Table 9: Result of Item: Balance on tiptoes

	Tiptoe Balance Item		
	Precision of movement	Fluidity	Flexibility
Average	1,4	0,65	1,1
Standarddeviation	0,58	0,57	0,7
Max	2	2	2
Min	0	0	0
C.V%	41,64	88,04	63,63

4.4 Correlation between the results of the Corsi Cubes test and those of the Charlop-Atwell coordination scale

Empan location is positively correlated with objective score, subjective score and total score.Back span is positively correlated with objective score (S0), subjective score (SS)and total score (ST). The objective score is positively correlated with the place span (r:0.75; P = 0.0001).The objective score is positively correlated with the back span (r: 0.89; P = 0.0001).

Table n ° 10: Matrix of Correlation coefficients

	Correlation (Spreadsheet18) Marker correlation are significant at p <0.05000 N = 49 (Casewesedelection of missing data).		
	Score objective (SO)	Score subjective (SS)	Total score (TS)
Span place	0.75	0.68	0.73
Back span	0.89	0.85	0.88

5 Results of Charlop-Atwell and Cubes de Corsi.

Figure 1 clearly shows the very significant correlation between the span and the objective score recorded on the coordination scale

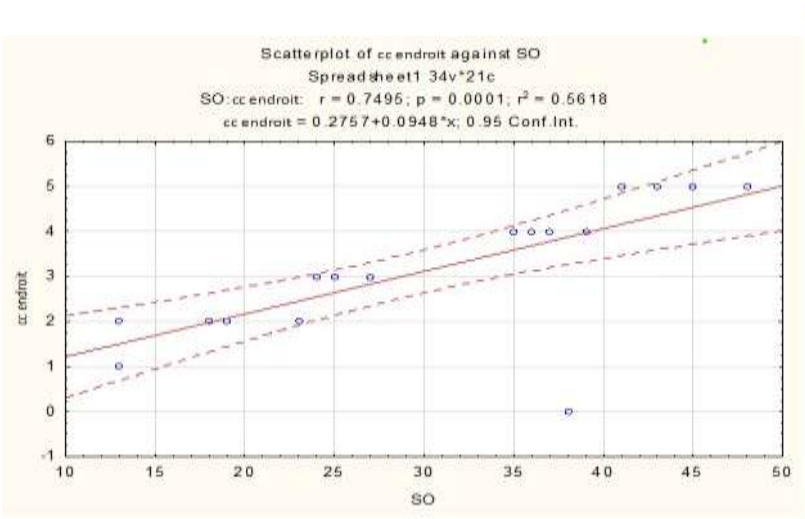


Figure n ° 1: Correlation between place span and objective score

Figure 2 clearly shows the very significant correlation between the back span and the objective score recorded on the coordination scale

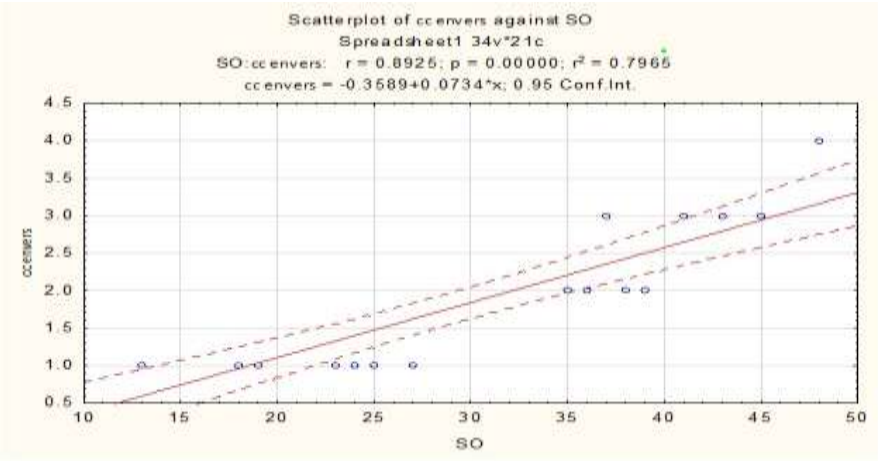


Figure n ° 2: Correlation between Empan upside and objective score.

Figure 3 clearly shows the very significant correlation between the span and the subjective score recorded on the coordination scale

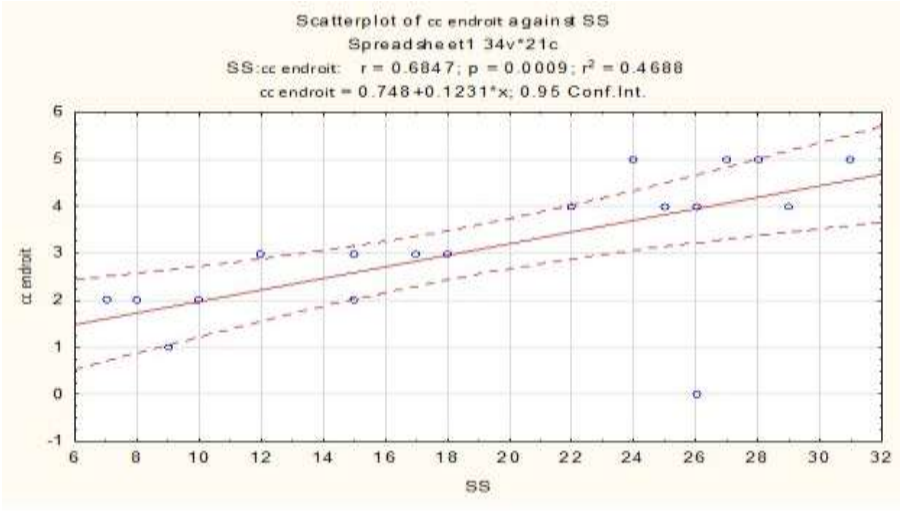


Figure n ° 3: General correlation between place span and subjective score

Figure 4 clearly shows the very significant correlation between the back span and the subjective score recorded on the coordination scale (r: 0.85; P = 0.0001)

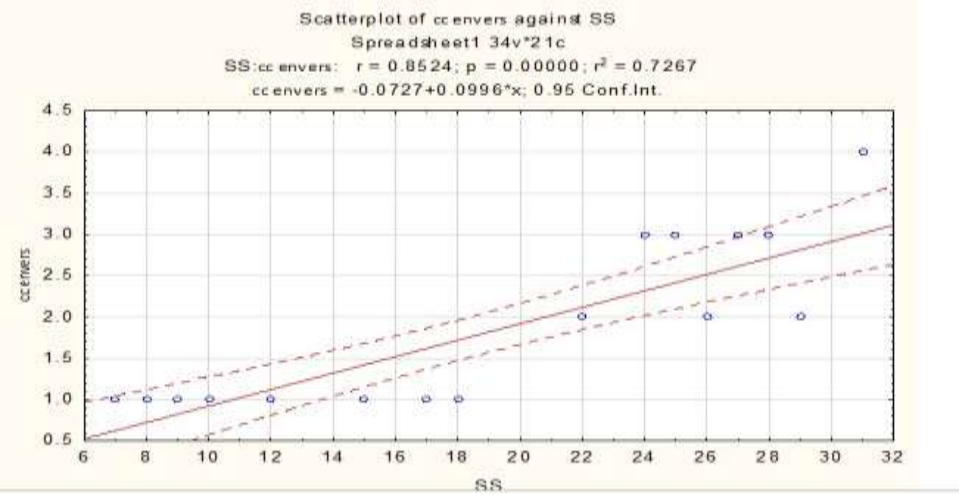


Figure n ° 4: General correlation between back span and subjective score

Figure 5 clearly shows the very significant correlation between the span and the total score recorded on the coordination scale (r: 0.72; P = 0.0003)

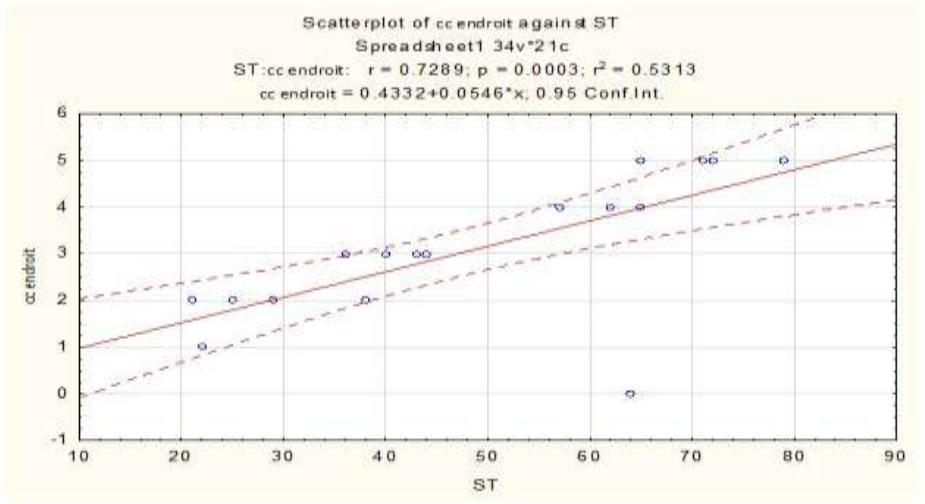


Figure n ° 5: General correlation between Empan location and total score.

Figure 6 clearly shows the very significant correlation between the back span and the total score recorded on the Charlop-Atwell coordination scale (r: 0.88; P = 0.0001)

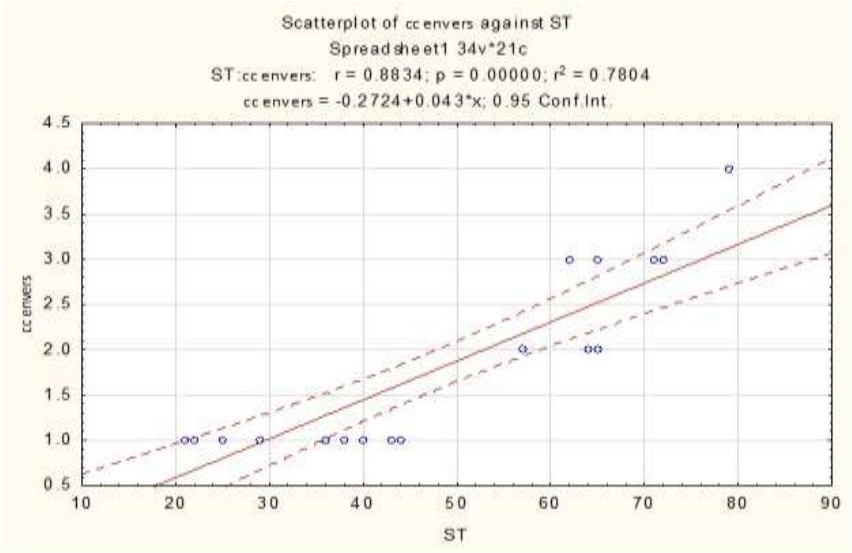


Figure n °.6: General correlation between Back span and total score

Discussion of the results:

Regarding the Charlop-Atwell Motor Coordination Scale, we find that the children in our sample performed poorly compared to the Albaret 2014 calibration, which is equivalent to saying that they lack general motor coordination, we also note low values with the test of the cubes of Corsi we refer to the calibration of Fournier et al. (2014) which shows a failure of the visuospatial component of the working memory (MDT).

The correlative study showed that motor coordination is strongly and positively correlated with short-term MDT memorisation ability, this coincides with the study of Wilson and McKenzie 1998 who found in their work that half of children with AD / HD, Learning Disorders / Hyperactivity, have motor difficulties that they have assimilated to a developmental coordination disorder, Marin 2010 associates this correlation with visuospatial processing deficits, in the same sense, Van Der Kaa et al. 2007 support that memory work, among other components, has the tasks of (keeping events in mind, handling or reacting to events, limitations of complex behavioural sequences, function of returning to the past (retrospective), forecasting function (prospective), anticipation and finally the notion of time and temporal organisation of behaviour) which focus on the control of motor skills and fluidity.

the contribution rate of kinesthetic perception and the speed of kinetics pons that Sector numbers, and predictive equations for the accuracy of the numbers in terms of the types of cognitive and dynamic sense of the speed of the motor response

Conclusion

Indeed, as we have reported through the authors, the memory system is, responsible for coordinating information to successfully plan actions and make decisions, and according to research, which has alluded to the link that exists between working memory and coordination (control of motor skills), we can say that in our study we note a strong positive correlation between motor coordination and the ability to memorise in the short term in children aged 6 who make up our samples, we need to incorporate these parameters into our training and motor education programs in order to hope to achieve higher levels of performance and see our national teams compete with the great volleyball nations.

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1 نور الدين قويدر برنامج مقترح للألعاب الحركية كمرتكز في تنمية بعض القدرات الإدراكية (الحس-حركية) لأطفال ما قبل المدرسة (4-5) سنوات مجلة تفوق في علوم وتقنيات النشاطات ا البدنية والرياضية المجلد 3 العدد 3 سنة 2018

2 رضا مالك اقتراح برنامج تعليمي في التربية الحركية لتطوير بعض المهارات الاساسية الحركية والقدرات الحركية لتلاميذ المرحلة الابتدائية 6 - 9 سنوات مجلة تفوق في علوم وتقنيات النشاطات ا البدنية والرياضية المجلد 1 العدد 1 سنة 2018